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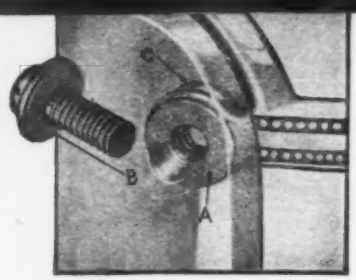

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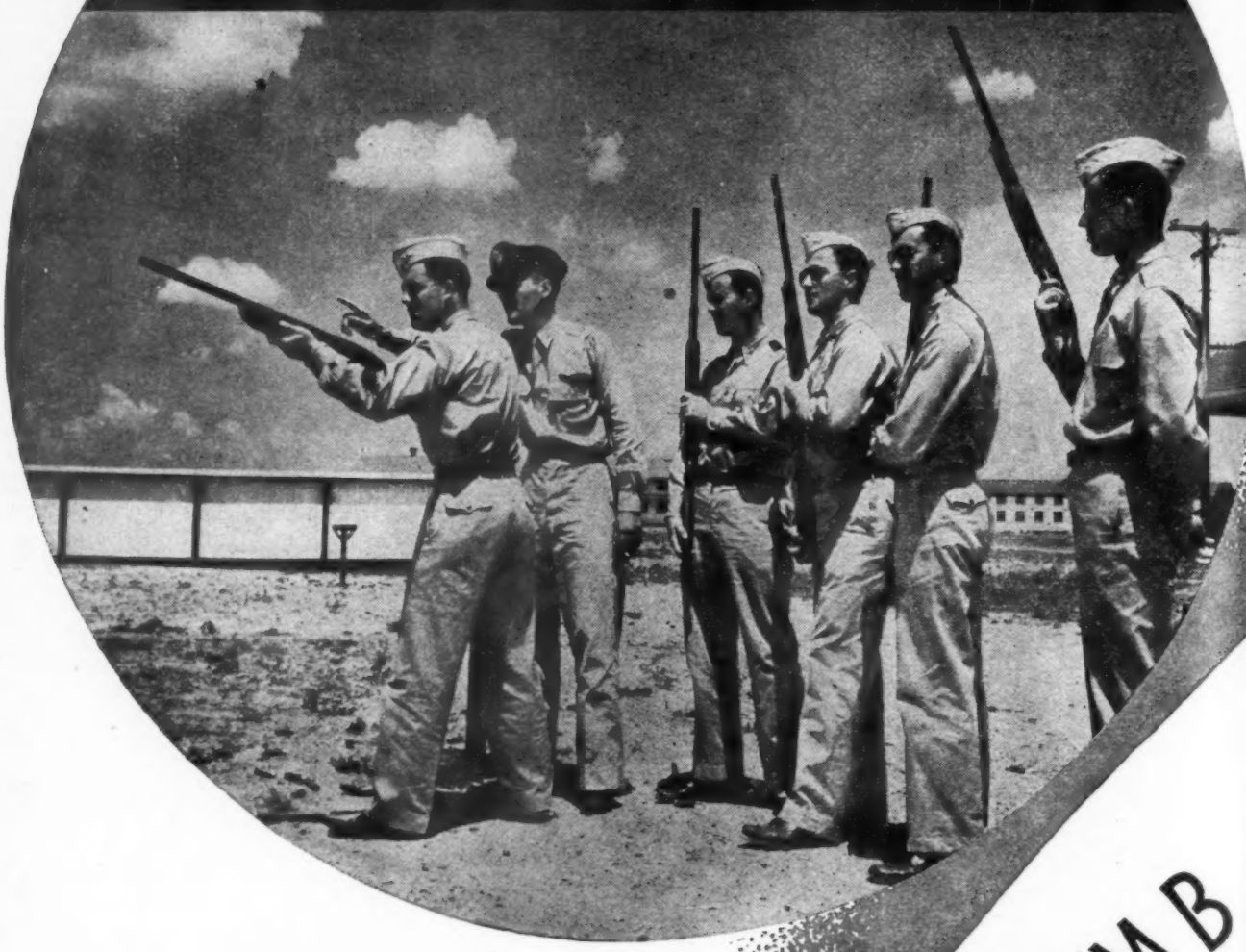

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RESULTS OF EXPERIMENTAL WORK TO DEVELOP A RAPID SCREENING TEST FOR ANISEIKONIA *

H. L. Fuog, Opt.D.,
Los Angeles, Calif.

An aniseikonic screening test, to be effective for office use, must permit of rapid judgments of practical accuracy. Such a test device should (a) be of simple design; (b) be of easy and rapid adjustment; (c) be provided with indicating scales which can be clearly read; (d) disclose over-all and meridional ocular image effects; (e) possess an accuracy of at least ½ of 1%; (f) possess easily adjusted means for neutralizing lateral and vertical heterphorias.

Such an experimental device has been in use in the writer's office for some time, and one of similar design was given to a colleague for the purpose of gathering data.

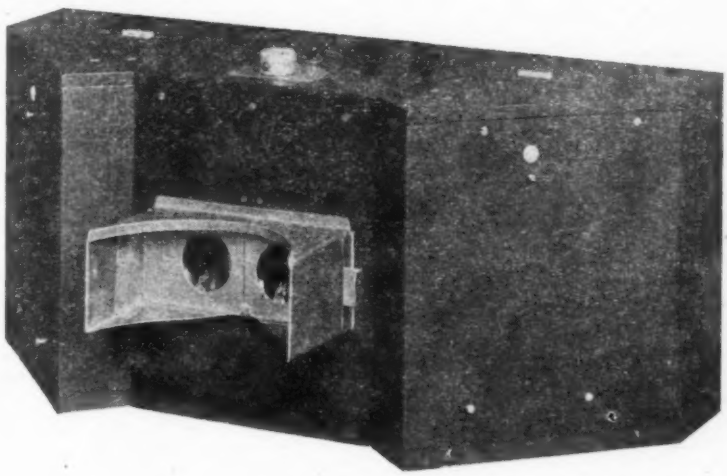

Fig. 1

A simple vertical tilting plane (of Dartmouth design) was constructed, and has been used for two years. For yielding *clues* of anisei-

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konic disturbances, together with affording approximate measure of this condition, it has proven to be a valuable device.

The original Dartmouth method and device, in the writer's opinion, was never intended as a clinical office instrument, having certain disadvantages when used for that purpose. The test required too much time and the equipment required too much space. Their new instrument does much to correct both these faults.

The vital importance of aniseikonia is worthy of more attention than is accorded it. It is the *only answer,* in many cases, of anomalous visual functional behavior, efficiency, and discomfort. Whether the present explanations attached to aniseikonia manifestations are questioned or not, such questioner can not ignore the demonstrable and factual before-and-after effects in visual behavior, skills or agility, integrity of fixation, and ease of seeing following acceptable correction of aniseikonia. Ocular image size difference is a fact; what its significance is, in a given case, will be referred to later.

The essential elements in the writer's screening device are the adjustable target indicators, as seen by the right and left eye, respectively. They are used in a reflecting type stereoscope; the stereoscopic device developed by Parkins of Ord, Nebraska, is useful for this purpose, but requires much smaller targets.

WRITER'S ROUTINE PROCEDURE—TIME: 5 TO 10 MINUTES

1. Cardboard replicas of superimposed targets are shown patient. These consist of (a) vertical image size difference; (b) horizontal image size difference; (c) no size difference.

2. Patient now views superimposed targets in reflecting stereoscope: (a) indicators are now moved, for vertical demonstration, by manually moving pointer across the scale to the extreme right and, immediately after, to the extreme left, producing about 6% difference larger, and 6% smaller, size difference; (b) align vertical indicators (three trials); (c) horizontal indicators are now moved 6% smaller and, immediately after, 6% larger, with other pointer; (d) align horizontal indicators.

DETERMINATION AND MEASUREMENT OF ANISEIKONIA IS INDICATED

When equality of indicator position has been attained by the patient, the right, or left, target pointer is to the right, or left, of the zero position or is at the zero position. The scale is ruled in ½ of 1% separa-

tions, and with more refinement in manufacture than the writer's home facilities afforded more exact measurements could be made.

If hyperphoria is present, right or left target is slipped up or down in friction holder, as needed to neutralize the retinal slip.

If eso or exophoria is present, the angling mirrors are quickly adjusted to neutralize horizontal retinal slips.

IMPORTANT DIFFERENTIATION

Studies made with a 3% cylinder size lens, before the eyes of persons with no aniseikonia, placed at 15 degree intervals around the protractor scale in front of the eye, indicate the resultant effects of such angled cylinder size lenses in the vertical and horizontal meridians. These studies, made on the writer's device, indicate that such vertical and horizontal resultant effects are similar to the vertical and horizontal resultant effects of cylinderic refraction, when the axis thereof is in oblique meridians. For example, screening clearly indicates 1½% *over-all* correction required for the right eye to equalize the ocular image in the vertical and horizontal meridians. Such an indication of aniseikonic size difference may be due to (a) true over-all size difference of 1½%; (b) 3% meridional size difference, axis 135 or 45 for the right eye, whose ocular image is relatively smaller than that of the left or, (c) 3% size difference, axis 135 or 45 for the left eye, which would have the relatively large ocular image.

A descriptive analogy might be found in a consideration of a plus 3 cylinder, axis 45, as a refractive prescription. The vertical and horizontal refractive effects of this corrective cylinder is plus 1½ diopters; however, it is obvious that a plus 1½ sphere, although having the required refraction in the vertical and horizontal meridians, would not be a suitable or acceptable correction. Of course, we are not hampered in our differentiation of the cylindric as compared to spherical condition mentioned. The various astigmatic dial charts, use of the retinoscope, the data from the ophthalmometer, and various visual acuity tests solve this problem.

The resultant vertical and horizontal effects of obliquely inclined cylinder size differences vary as the square of the sine and co-sine of the angle of such obliquity, with respect to the horizontal and vertical meridians. Another example: the right eye prescription requires a .50% over-all, combined with 1.50% cylindric size lens, axis 180, to equalize

the ocular images. This vertical and horizontal size effect could also be the result of a 2% cylindric size difference, axis 150.

Over-all size difference determined from *fixed* vertical and horizontal readings in routine screening can be quickly checked in the writer's device by rotating each chart to an angular position of 45 degrees or 135 degrees of the protractor in front of the eyes. (a) if the indicators remain identical in appearance, a true over-all size difference exists; (b) if a new alignment of the indicators is required, showing equality of size in one oblique meridian at or near the zero position, and, if approximately twice the previously ascertained over-all size difference is shown in the opposite meridian, then it can be said an oblique meridional size difference exists; (c) it is obvious "a" and "b" above are quite unlike, and the correction for one would not be suitable, or acceptable, for the other; (d) this applies in principle to almost all determinations confined to fixed vertical and horizontal meridians; (e) compound size differences, determined to exist for either eye, resulting from measurement in the vertical and horizontal meridians only, can be transposed to equivalent oblique position size differences, and then checked quickly in the writer's device for correctness.

Ocular image size difference is equalized or "corrected" by altering the size or shape of one, or both, *retinal images.*

It is obvious that magnifying the smaller ocular image will equalize the difference between the two, but it is a question if reducing the larger one to that of the smaller would not be the best procedure in a given case. The matter of considering the dominant eye status in this respect is important. A person exhibiting a central suppression of one eye reveals thereby that a *final preference* was given to the ocular image of the other eye. This would appear to dictate that, to achieve most acceptable equality of ocular images, we should change the one belonging to the eye centrally suppressed, if necessary, by reversing the usual position of the correcting size lens, or in fitovers; that is to say, place the concave surface outward. Giving consideration to the dominant eye and the non-dominant eye ocular image status would be consistent and analogous with similar consideration for other visual anomolies. This matter of differentiating over-all and compound from oblique meridional size and shape difference, also whether to magnify or reduce such ocular images is important, in this writer's opinion.

Through the courtesy of Dr. E. A. Hutchinson, Dean of the Los

Angeles School of Optometry, the writer was able to use the Wichart's tilting plane and certain studies were carried on in the hope of finding supporting clues which might aid in the differentiation of oblique axis position. Using a 3% cylindric size lens before eyes with no aniseikonia and placing such size lens at 15 degree intervals around the protractor in front of the eye, it was found that, as the angular position approached

TYPICAL OF THESE *VERTICAL TILT PLANE* STUDIES IS THAT OF MR. McB. (NO ANISEIKONIA)—EMMETROPIA

10 seconds allowed to adjust plane. Eyes closed while plane is mal-positioned, preparatory to next observation, and adjustment so as to appear as a flat frontal surface.

	RIGHT EYE	
AXIS OF 3% CYL. SIZE LENS	LEFT EDGE OF PLANE	LOW EDGE OF PLANE
90	RECEDED 17°	NEARER 0°
105	" 15°	" 6°
120		" 12°
135	NEARER 2°	
		" 15°
150	" 5°	" 16°
165	" 10°	" 10°
180-0	" 18°	RECEDED 2°
15	" 16°	" 10°
30	" 10°	" 15°
45	RECEDED 0°	
		" 17°
60	" 10°	" 15°
75	" 15°	" 10°
90	" 17°	" 0°

For our present purpose, the clinically noteworthy factor is that whenever the cyl. size lens is positioned other than directly vertical or horizontal, the plane reveals vertically inclined effects in addition to horizontal inclinations.

that of 45 degrees from the vertical or horizontal meridian, the tilting plane revealed a maximum rotation around a transverse horizontal axis; that is to say, the lower or upper margin of the vertical tilting plane would be nearer or farther from the observer, but seen as a flat frontal surface by him. As the size lens became vertical or horizontal in position, the aforementioned rotation decreased to a practical zero quantity, but the rotation around a vertical axis increased and was at a maximum when such size lens was vertical or horizontal. When the cylinder size lens in the reverse position is used, concave side outward, thereby reducing the ocular image of that eye, similar phenomena occur; but all these tippings of the plane are *opposite* in character to those when using the size lens in the magnifying manner, for the same eye. Magnifying the right image has *similar effects* as reducing the left eye ocular image.

Ames [1] refers to this matter as follows: "These phenomena are easily demonstrated with meridional size lenses of, say, 2% to 3%, held, first, right eye: axis 45; left eye: axis 135; then right eye: axis 135, left eye: axis 45, and observing the floor and ceiling." This had reference to a horizontal plane.

Therefore, when a person, with or without refractive correction, as the case requires, adjusts the tilting plane in order to see it as a flat horizontal, or frontal, surface, with the near edge, in case of a horizontal plane, elevated or depressed, or the low edge, in case of a vertical tilting plane, is closer or farther removed, it serves this writer as a cue to investigate the possible oblique position of a meridional size difference.

These studies, conducted for finding *possible clues* for such differentiation, were undertaken because of the remaining casualty list at present recorded in the field of correction for aniseikonia. Boeder [2] mentions the following: "Aniseikonia has been measured and corrected by the Dartmouth Eye Institute, two other Eastern Clinics, one Midwestern Clinic, and two private practitioners, during the last few years, and about 3,000 patients have been fitted with iseikonic lenses. In about 65% to 70% of these cases, *relief* has been *obtained* from *disturbing symptoms*, and in many cases there has been complete relief from physical, emotional, and psychological disturbances."

From this summary it is evident that 30 to 35 per cent of these patients have achieved little or no alleviation of their difficulty. Possibly, the development, or refinement, of previously mentioned, or other differentiation, tests may materially reduce this per cent of casualties.

TOLERANCE OR AMPLITUDE TO DIFFERENCE OF SIZE OR SHAPE OF OCULAR IMAGES

Several years ago the writer carried on some studies with divided cardboard diagrams; then, subsequently, developed an adjustable holder over which was stretched sheet rubber. Simple designs were ruled, and some dotted, upon each of the two targets used in the reflecting stereoscope. Either one of such diagrams was stretched vertically or horizontally, or in both directions at once; also the entire target was revolved in clockwise manner to various angular positions, then stretched as before, etc.

The slight widening or thinning of the lines or dots forming the figures upon the rubber is undesirable, but not serious within the limits of such tolerance found by this method. The highest found approximated 3%. However, the nature and character of size "amplitude" should be investigated. Maybe it is an expression of ability to adapt for size difference. But, again, it may be reduced ability to note such small changes in binocular visual sensation. Perhaps the gradual alteration in the size disparity is unnoticed, due to Pannum's fusional areas.

The phenomena of apparent size amplitude exists, but what its true character may be is not known to this writer.

There were differences between the various persons tested, depending upon (a) whether the dominant or non-dominant target was changed and, (b) whether the ocular images of these diagrams were enlarged or reduced.

Actual *performance* is the end expression of all participating elements in a particular person at a certain time and under the conditions of tests. The study of performance yields important clues of the integrity of functional status and capacity and aid in understanding a given consultant's case. Doane [3] uses this amplitude form of *performance response* as an important criterion when considering for or against complete or partial aniseikonic correction in a given case. Ames, Gliddon, and Ogle [4] cite one case of 5¼% amplitude by their methods of testing. In the light of usual quantities of response, this may be considered large in degree.

The data of degree of tolerance is used in a manner similar to that of duction response with respect to the significance of a phoria. To illustrate: 1% over-all correction required for the right eye, the amplitude is 3%. This would indicate a good compensatory reserve, but if the ampli-

tude was but 1%, it would indicate a poor, or inadequate, reserve. By analogy, a case shows one diopter of right hyperphoria, with right infraduction, shows 3D, and indication of good compensatory reserve. On the other hand, if such right infraduction were but 1D, it would indicate inadequate reserve. These may also be considered, in a sense, the measure of liabilities and resources, to which Charles Sheard referred to as the "Law of supply and demand."

The whole purpose of relating or comparing such data is an attempt to find clues to aid in appraising the significance of such visual anomalies and responses and is, in this writer's opinion, good procedure.

With further reference to tolerance, it appears there is a great difference between disparity of the central field with similarity of peripheral field, as compared to that when the peripheral field participates in the disparity of size. It is generally conceded that if the *ocular images differ* more than *4%* to *5%* (central and peripheral field *both* enlarged or reduced) binocular vision is given up in favor of monocular patterns of seeing. It can be inferred then that aniseikonia does not merely pertain to one certain object in the field of view in a stereoscopic field, but rather that all objects within the common perceptual field differ from that seen by the other eye. This is further somewhat supported by the measure of the tolerance to an *ocular image* difference, "amplitudes" of 3% to 4% being considered large.

However, if the common *field* of *view* in the stereoscopic field *is equal* in *size* and *shape* for *each eye*, it appears flat (not rotated), and a great *disparity* of *one object difference* can be fused or neutralized. To illustrate: American Optical Company stereoscopic charts possess a card, E8, submarked Javal G, which presents *arrows of 24% difference* in physical size, with reference to their length. When viewed stereoscopically these arrows are *fused*, and rotated about a vertical axis.

Comparing the two above responses, it appears that the status of the peripheral (indirect) field, with respect to ocular image size difference, or similarity, plays a major role.

Ames [1] has pointed out: "Through their perspective sense, which is affected by aniseikonia only very slightly, or not at all, persons interpret the orientation of surfaces, planes, and groups of objects correctly.

"Through their stereoscopic sense, persons with aniseikonia falsely interpret the orientation of surfaces, planes, and groups of *objects con-*

sidered as a *whole.* The extent to which their total visual judgment is affected by their false stereoscopic sense depends upon the predominance of perspective features in the field of view."

Another form of central disparity, but peripheral field similarity, is presented by chart E7, submarked "Hale." Viewing the two inclined arrows, when fused or neutralized, gives the impression of an angular position as if rotated around a horizontal axis. The impression obtained from a *disparity* of these *central field objects* is similar to the *tipping effect* obtained upon the *whole field* of *view* of a vertical or horizontal tilting plane when viewed through cylindric form of size lenses in oblique positions. In passing, it might be stated that an adjustable disparity of central field object, as in card E8 mentioned above, or others of a like character, would furnish an excellent means of determining the amplitude of neutralization and, therefore, is a good performance test to determine the tolerance or amplitude of stereopsis. Stereorthoptor targets No. 3 (decentered circle) is of this nature, but could be improved.

SIGNIFICANCE OF ANISEIKONIA IN A GIVEN CASE

This is the crux of the whole matter. Such significance has been principally directed to the possibility of alleviating discomfort, such as recurring daily feeling of general tension, nervousness, and persistent headache, photophobia, reading difficulties, and fatigue, etc. However, there is much more significance to the presence of this visual anomaly than that of discomfort only, some of which can be mentioned:

a. aniseikonia and central suppression. In this connection Carleton and Madigan [5] have mentioned two kinds: size suppression and refractive suppression. They reported 71 per cent showed this effect. They attach, and rightfully so, great importance in evaluating the soundness of their corrections, taking the position that if suppression persists, they presume the prescription is not correct.

b. the possible reduction of large phorias and other fusional anomalies.

c. persistent difficulty in reading, etc.

d. inefficiency of visual functional performance, wavering fixation, etc.

e. enchancement of visual skills, reading speed, comprehension, etc. Improved stereoscopic appreciation.

f. impaired ability and disinclination to maintain fixation, interest, and concentration.

Appraising or evaluating any human response data, in a particular case, will always challenge the one conducting and analyzing the test response. Continued experience finally permits a *reasonable assurance* of success. In correcting fixation difficulties with prisms or orthoptics, correcting refractive anomalies with spheres or cylinders, *correcting aniseikonia,* all partake of an experimental procedure, the *final significance* of which, to *the individual,* can be determined by (a) the patient's visual experience one week, one month, or three months after wearing any suggested correction; (b) your record of improved or changed response of your regularly made tests of visual functional behavior. And of the above two subdivisions, "a" will almost always be more important than "b," and "b" may be in agreement with "a," but not necessarily so.

It is generally stated that 70 per cent of a population has a measureable aniseikonia. From experience, this writer believes the discomfort group is the smaller part, the larger group being composed of those in which the aniseikonia promotes various other departures in functional status and performance of vision.

CORRECTION OF ANISEIKONIA

All lens corrections for difference in size and shape of the *ocular images* are dependent upon changing the size and shape of the *retinal image, or images, from those from which the ocular image difference was determined.* The Dartmouth method of changing size and shape of the retinal image and, therefore, the ocular image during the examination procedure is to place before the eye various plano lenses (or one variable lens system) of spherical and cylindrical form having properties of magnification but no focal power. These are changed until the patient's judgment reports equality of indicator position.

The writer's device alters the size and shape of the retinal image and, therefore, the ocular image by directly altering the test indicators on the object viewed. Trial size lenses can be used for check testing, but are not necessary for screening purposes.

Altering the base curve of a refractive prescription, its center thickness, its distance from the cornea, will alter the magnifying effect of such a lens; also placing various plano curved lenses with various thicknesses in a fitover before the refractive prescription also obtains magnification effect.

Whatever change is made in the *form* of lens curve or thickness, or whether a fitover is used, the writer's device permits a rapid checking of the changes finally resulting in the ocular images, as compared to those initially discovered.

ABILITY TO COMPENSATE

Ames[1] poses the following pertinent question: "Does a similar false steresecopic interpretation of the position of surfaces exist in cases in which the aniseikonia or difference in size of the ocular image is of *long standing?* Or do those who have aniseikonia *learn through experience* to make compensation for the false impressions they receive?"

(Sixty-five consecutive aniseikonic patients were tested.) "Not one of these sixty-five showed normal stereoscopic sense of depth; i.e., not one could set the tilting table level."

The ability to experience various kinds and intensities of visual disturbances, the inherent, and, possibly, the acquired ability to absorb or neutralize the effects of such disturbances must ever largely remain as an *individual matter* in a given person.

Troland[6], in the writer's opinion, states this very clearly, "The synthesis of corresponding and of disparite binocular currents, on the other hand, is probably dependent upon neutral connections which are established by *'experience,'* such connections being limited, but not accurately determined, by anatomical features. The general law governing such associated combination is seemingly that of a convergence and fusion of sufficiently similar and sufficiently adjacent nerve currents."

If the effects of such disturbances result in disagreeable or painful sensations, or, what is equally important, reduce the efficiency and performance of a person's various binocular activities, they arouse his interest in their possible significance to his welfare. Usually at this time a refractionist is consulted; however, in another case the effects of similar disturbances may be so neutralized that no disagreeable sensations are aroused, but the residual effects on some of the other binocular activities can persist, as central suppression of one eye, faulty fixation, poor stereopsis, etc.

It is not good practice to predicate the significance of aniseikonia upon the presence or absence of discomfort only; in fact, experience indicates the true discomfort ones are in the minority.

Compensation or adaptation to ocular size difference may be said

to be either positive or negative in character. That person with wide tolerance or amplitude may be said to have achieved, or been possessed of, a response mechanism which adequately met the visual discrepancies and may experience no *discomfort* therefrom, but reveal anomalous binocular test reactions.

Another person, with less adequate facility, may yet be struggling to maintain binocular accuracy and have severe discomfort. There are many factors which could terminate such expended effort and, in that event, comfort can ensue. Another person, of larger ocular image discrepancy, may give up, or perhaps never have excercised, central binocular fixation and have no discomfort, certain concessions being made in the form of suppression or suspension of vision. These, then, could be classified as negative compensation. It is true that certain visual skills and compensating activities can be enhanced through suitable and repeated training periods. Perhaps it will also be possible to enhance the size difference amplitude in order to better compensate for aniseikonic discrepancies. This does not infer, however, that any change should necessarily occur in the degree of the aniseikonia.

It would also be well to mention that any vertical or lateral prisms that are required in the refractive prescription must be before the eyes when making final aniseikonic determination. In passing, it might be well to state that a prism will lose much of its distortion of the field of view when ground on base curves of approximately nine diopters. The distortion of flat prisms can be readily observed with the use of the writer's device.

CORRECTION—COMPLETE OR PARTIAL

It is proper to assign more importance, for example, to 1½ D. of hyperphoria in a given case, than a similar amount of lateral phoria. In any event, when prescribing such vertical prism, those that will equalize the vertical ductions inspire more confidence in their acceptance, regardless of the per cent this correction may be to the hyperphoria revealed, than the measure of the phoria alone. Such a prism is almost always a partial correction, with reference to the degree of the muscular imbalance.

In a manner analogous to this, the correction of aniseikonia may be considered, with reference to the amplitude or tolerance for size difference. However, the response obtained from the tilt plane, or table, the eye before which the ocular image change is made, are factors to be used as a guide also.

The various methods to synthesize data guarantees very little. It merely affords one an approach leading to reasonable assurance of success in a given case.

CAUSES

Unequal distribution of retinal or optic nerve fiber elements[4] and, possibly, an unequal reception in the terminal brain cells is a suggestion presented to account for aniseikonia with emmetropia. However, it is quite possible that the ophthalmometer data may prove of importance in such instances. Approximately 75 per cent of the eyes' total power to focalize images is produced by the cornea. It has been this writer's experience to have noted as much as 3½ D. difference in the corneal power for so-called emmetropes, or near-emmetropes, and it, therefore, seems reasonable that from this difference in each eye, the nodal point position is affected and, in consequence, a difference in the relative size of the retinal image and, finally, this could be expressed under test conditions as a difference in ocular image size. Ames, Gliddon, and Ogle[4] make the statement that 2½ D. of accommodation, by moving the nodal points, will cause an over-all change in ocular image of about 1 per cent.

Carleton and Madigan[5] state that anisometropia of 1½ to 2 D. changes the size of the ocular image about 4 per cent (and, since 4 per cent to 5 per cent difference is about the limit, and maintain single binocular vision, from this it would appear that we have another clue as to the anomalous status of binocular vision occurring in such cases. A pertinent point is that some anisometropes have obtained and enjoyed efficient binocular vision, including differences as much as 3 D.).

CAUSES—ANISOMETROPIA

Anisometropia is offered as a cause of ocular image size difference, because of the inference that the retinal image size is different. There are, however, many exceptions.

An anisometropia of 2 to 3 D., showing *equally curved* corneas, can be quite different from one whose corneal *curves* are in *agreement* with the refractive difference, or different from one wherein the corneal *curves* are in *disagreement* (reversed) to the *unequal refraction* between the two eyes. It is quite possible that the altered position of the nodal points are important to the final visual appreciation of ocular size similarity or difference.

It is obvious that many eyes can require identical refractive prescriptions, yet because of varied nodal point position in one as compared to

the other eye, have a disparity of retinal image size and, because of this, could have aniseikonia. Regardless of the several factors which eventuate into an ocular image size difference, equalization thereof is achieved by altering the *existing* size of one or both retinal images in various ways.

The question may now be posed, "Why, if ocular size and shape difference exists, do we not notice this generally?" Ames, Gliddon, and Ogle[4] state that, "generally, because of masking by fusion, due to Pannum's areas, the ocular image size is not noticed."

Finally, it may be stated, (a) comfort and efficiency, with anisometropic prescriptions, is a fact; (b) comfort and inefficiency, with anisometropic prescriptions, with inadequate binocular attributes, is a fact also; (c) discomfort, with correct refractive anisometropic prescriptions, is also a fact.

Aniseikonia may be present in subdivision "a." This writer would not correct it. If present subdivision "b" and visual efficiency for work environment is required, it would be attended to. If, by age, no such demand for efficiency exists, consideration of other factors would be required for final decision. For subdivision "c," aniseikonia being present, this writer would correct it.

Fisher[7] has suggested certain methods of detecting large ocular image size differences but, since the great majority of the cases tested are less than the inferred per cent difference disclosed by these methods, their value is questionable as a routine procedure. Madigan[8] makes a very positive statement of the necessity of having simultaneous binocular vision, etc., to rely on aniseikonic determinations. However, he also states[8] that a visual acuity of as low as 20/60, if about the same in the two eyes, is still productive of good aniseikonic correction.

Charles Sheard has always sponsored the axiom of "To determine the status or performance of visual functions—test them."

This writer, since 1939, desiring to know how various visual functions react and adjust to the intrusion of various over-all size lenses, placed them before the eyes of many persons, in fitover form, at random at times, and under known conditions, in most instances. This was done for ten minutes (shortest period) to one month (longest period) then their experiences and the alteration, kind, and degree of the functional behavior were recorded. This latter was of primary importance, the discomfort (headaches, etc.) secondary.

The true purpose was not disclosed; such fitovers were called "Re-adjustment Lenses"—and they were. Both militant and humorous experiences were encountered. Some did not return—their data and the fit-over being lost.

The writer considers his experience of interest; two outstanding convictions resulted: (1) The particular nature and degree of response persons make to a disturbance of their visual status-quo is strictly an individual matter; prediction of effect is unreliable. (2) If those with aniseikonia must contend with and adapt for this visual anomaly, in a manner similar to the experimental subjects and which, in this writer's experience, they do; then the critical importance of aniseikonia can not be shunted aside or ignored. Refractionists, "Near-Point Hobbyists," and Orthoptists will do well to re-evaluate the significance of their present regularly-made test data, with reference to aniseikonia and its effect upon binocular vision.

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[5] "Size and Shape of Ocular Images," Carleton & Madigan, Dartmouth, 1932.

[6] "The Optics of the Nervous System," Leonard Thompson Troland, Ph. D., Am. Jr. of Physiologic Optics, April, 1924, reprint by Riggs Optical Co. in "Optical Developments."

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PERCENTAGE OF DRIVERS WEARING GLASSES BY AGE AND SEX*

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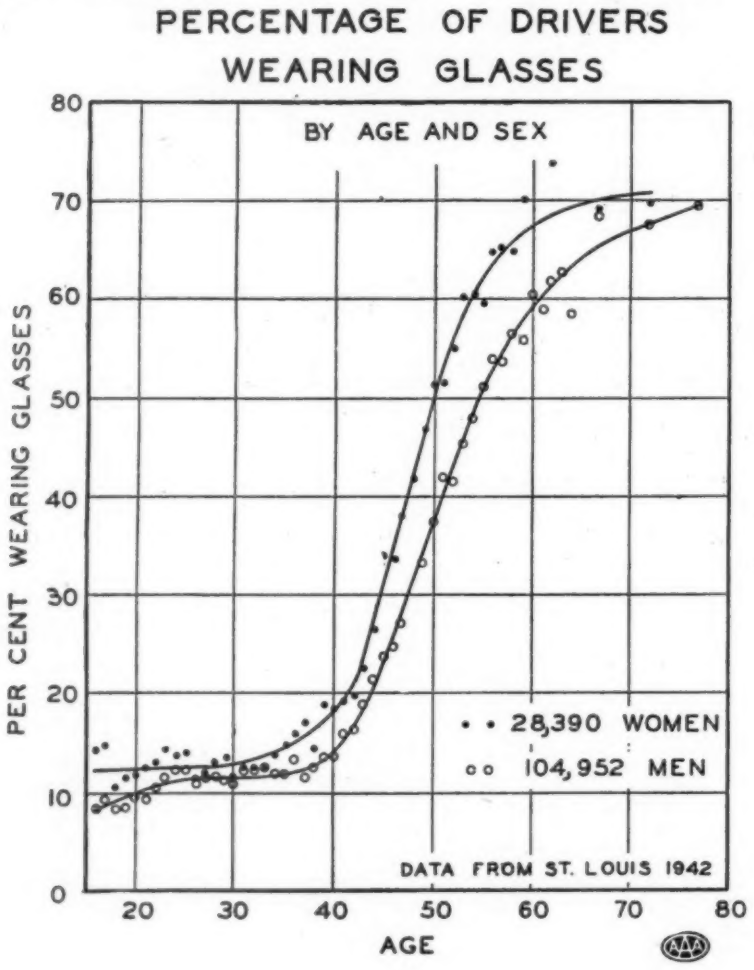
About one-eighth of persons under 40 years of age applying for operator's permits wear glasses. There is little change in this percentage from 20 to 40 years of age, but from 40 to 60 there is a rather rapid increase in the percentage until at the age of 60 three persons out of five



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applying for permits wear glasses. This is graphically illustrated in the accompanying chart based on data from St. Louis for 1942.

Since the wearing of glasses usually indicates the presence of some visual defect it appears that few additional defects are noted after the age of 20 and before the age of 40. However, after 40 various visual deficiencies begin to appear and correction becomes necessary. This indicates the need for more frequent visual examination of drivers over 40 years of age than for younger drivers in order that visual defects may be discovered and corrected before they become a driving hazard.

For drivers of all ages one-fifth wear glasses. (21.4% of the women and 21.3% of the men.) While the sex difference is small, it holds true for all age groups.

The data upon which these conclusions are drawn are sufficiently extensive to be typical of drivers in general and particularly urban drivers. It does not necessarily follow that the same trend would be observed in the population as a whole. It is quite likely that the vision of many elderly people is sufficiently deficient to discourage them from seeking an operator's permit.

The information used in this analysis was obtained from the report of the Department of Streets and Sewers, St. Louis, Mo., for 1942. The graph for men is based on 96,293 white operators and 8,659 colored operators. The graph for women is based on 27,113 white operators and 1,277 colored operators.

TRAFFIC ENGINEERING AND SAFETY DEPARTMENT
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OBSERVATIONS ON THE TREATMENT OF MIGRAINE*

H. B. Marton, F.B.O.A. (Hons.)

Since the publication of the work of A. E. Turville on the subject of migraine, refractionists have paid considerable attention to the condition, and the fact has been established that specific optical correction has been able to bring a considerable measure of relief to the sufferers from this distressing complaint. In spite of this progress, however, our knowledge of the fundamental nature of migraine has not increased, and we have still to be content to recognize it by the patient's recitation of his symptoms.

There can be no doubt that the condition is not in itself of ocular origin, for we have marked examples in which the most thorough ocular attention, both from the refractive and orthoptic points of view, fails to bring relief yet where some relief has been obtained by other measures.

Two cases encountered by the writer proved to have their origin in ovarian irritation and ceased to exhibit symptoms when surgical attention had been given to them. Another case which defied both optical and medical attention responded in a very satisfactory manner to a form of psycho-therapy and has since remained free from symptoms for the last eight months. One case failed to capitulate to optical and to conventional medical treatment yet obtained considerable relief from homœopathy. Other cases are known where no relief can be obtained from any of the means available to us, and they continue with their symptoms until the advent of old age lessens and finally stops them.

It is fortunate, however, that the vast majority of examples of migraine prove amenable to optical treatment, and it is because of this that the refractionist can hold out some hope of alleviation for those who consult him. Between the group of cases which proves responsive and that which does not there is yet another group which is found to benefit from the use of suitable optical corrections even though the wearing of spectacles does not lead to an entire disappearance of the symptoms.

From the purely refractive standpoint it is exceedingly difficult to distinguish the individual members of these groups, but it has been found that those who do respond either wholly or in part to optical treatment invariably have depleted duction powers. One case of a female aged forty-five years was particularly noteworthy in this respect. She was kept under fairly continuous observation for a period of two years and it was

*An abridgment of the material in The Refractionist. Vol. 28, No. 501, p. 301.

found that an attack could be predicted, or that she could be advised that she had lately had one, by observing the findings of the fusion reserve tests.

This was a case in which the writer was never satisfied that optical means were adequate. She was emmetropic, and had a binocular amplitude of accommodation of 6 D. No heterophoria was manifest at six metres, but at near there was an obvious indication of a tendency to overconverge, a frequent complication in migraine. Weak base-in prisms were prescribed, and one month afterwards she reported that the number of attacks had dropped from two per week to two during the period of wearing the correction. During the whole time she was under observation no material change could be made in the correction, but she found that if for any reason she did not wear the lenses an attack made its appearance. It may be of some interest to note that she had a family history of glaucoma for several generations, although she showed no signs of it.

Another case in which the patient had manifest emmetropia and orthophoria at distance was a female aged thirty-two years. A slight but variable exophoria was present at near. The amplitude of acccommodation was 8.5 D. Duction powers and fusion reserves were low on the positive side, but normal on the negative. Prisms of 1.0 △ base-in were given for each eye, and since wearing them from May 8, 1937, no further exhibitions of migraine have taken place.

A third case, also in a female, was sent by a medical practitioner on account of the symptoms presented. Her age was eighteen years, and she was wearing R. and L. —6.0 D.S.

Refraction worked out with crossed cylinder and Snellen types resulted in:

R.E. —6.5 D.S.—1.5 D.C. ax. 100°=6/12.
L.E. —6.5 D.S. —0.5 D.C. ax. 50° =6/18.
The amplitude of accommodation was 13.0 D.
Routine dissociation tests gave:
½ △ Esophoria, 1.0 △ Right Hyperphoria at six metres.
2.0 △ Esophoria at one-third metre.

The fusion reserves proved to be too variable to admit of accurate measurement.

The correction indicated above was given in conjunction with 3.0 △ base-in divided between the two eyes. The lenses were fitted early in

January of the present year, and when she came for re-examination on February 25th she reported that she had not had an attack since wearing the new correction. She was seen again two months afterwards and stated that she had a slight exhibition of the symptoms following the extraction of a tooth. Her freedom from migraine has continued.

A case of refractive migraine in a male aged forty-five years was investigated.

R.E. 6/6, +0.37 D.S. —0.12 D.C. ax. 170° =6/6.
L.E. 6/12, +0.75 D.S. —1.0 D.C. ax. 80° =6/6.
1½ △ Esophoria at six meters.
Amplitude of accommodation 4.0 D.
2.0 △ Esophoria at one-third metre.

He was an outdoor worker and did not wish for a presbyopic correction. The refractive correction indicated above was given and worn constantly. The attacks of migraine ceased.

Migraine was exhibited in another male, aged thirty-eight years. He gave a history of corneal ulceration, which an examination with the slit-lamp confirmed.

R.E. 6/6, +0.25 D.S.=6/6.
L.E. 6/9, —0.25 D.S.=6/6.
Amplitude of accommodation of 4.5 D.
Manifest orthophoria at six metres.
22.0 △ Exophoria at one-third metre with Maddox Wing Test, and Maddox Convergiometer.

The small or hand Diploscope of Remy indicated a tendency to over-converge, and he could fuse the Javal F—L characters with plano prisms of 9.0 △ each base-out.

The fusion reserves at one-third metre were:
Positive 24.0 △
Negative 2.0 △

The indicated correction was given with 2.0 △ base-in for each eye.

One week afterwards he reported complete relief. Re-examination confirmed the above findings with the following differences:

Amplitude of acccommodation of 5.0 D.

Fusion reserves at one-third metre:
Positive 32.0 △
Negative 20.0△

It should be noted that the near-point exophoria remained at 22.0 △.

The patient has continued to be free from migraine and states that a long-standing digestive disorder has entirely disappeared. The effect of the correction has been very marked in respect of the latter, and his relief is attributed by him to the constant use of the correction.

The above examples have been selected from the case book because they are sufficiently representative of the condition.

It would appear that in many examples of migraine the refractive error has an important part to play, and in many of them the symptoms are provoked by the auto-correction of the error, or by attempts at such auto-correction, on the part of the individual. The attempt so long continued causes the error to be partially hidden, with the consequence that very often the manifest correction is not sufficient to compensate for the optical requirements.

In the attempt to arrive at a satisfactory correction, somewhat thorough methods have to be employed. It does not appear safe to take the examination under cycloplegia because many of the patients who have migraine are of a well-recognized type which at a later period of life often have glaucoma.

Any practitioner who has seen many cases of glaucoma will be able to recognize the distinguishing features which yet bear a remarkable similarity in the two conditions, and there is no doubt but that the symptoms of the one condition can be easily confused with those of the other. The one-sided headache can be common to both, and in spite of certain features can be confused. It is true that in migraine it comes on after the premonitory signs, but the memory of the patient as to what precedes it is often unreliable. During the actual attack we can sometimes find a marked dilatation of the pupils, the one on the affected side being slightly larger than its fellow, while a digital palpation of the globe reveals a distinct hardness.

In some of the conditions it is exceedingly difficult to distinguish between the two, and perhaps the most helpful observation is that of the subject's sensation of the photopic phenomenon which is never seen in glaucoma, but this is not invariably found in migraine. The similarity between the two conditions is emphasized by the fact that many subjects with migraine refer to their condition as biliousness, while medical publications reveal that glaucoma has frequently been mistaken for the bilious

condition. Hence it is that every patient who presents symptoms of migraine should be examined for increased tension.

The late Mr. A. J. Preston believed that there were many more conditions of glaucoma than were usually suspected, and no one can doubt that many of the examples of it are confused with migraine. We have to remember that glaucoma does not always manifest itself by the classic signs, that it can remain hidden for years without its unmistakable nature being revealed, that it is often exceedingly difficult to recognize, etc. All these tend to make a confusion between the two conditions possible, and the only solution to such a situation is to be found in the repeated clinical study of the individual case. The effect of a correction is probably the same in each case: the symptoms cease for a time and until this has elapsed there will be a lessening in the manifestation of the root fault.

When the refractionist has satisfied himself that migraine is present to the exclusion of the other condition he can direct his attention to the optical requirements of the subject. As remarked, particularly thorough methods are necessary and every case should have the benefit of careful keratometry, retinoscopy and subjective test. The retinoscopy can well include the so-called dynamic method because many of these cases have accommodative tensions and disparities to which a clue can be found by considering the dynamic findings in the light of other results. The most accurate subjective test can be made with the crossed cylinder and the Snellen types, and can be confirmed by means of the Maddox V and contrast block in conjunction with an astigmatic fan.

Care is necessary with the spherical portion of the test, and experience indicates that some such procedure as the following is advisable: The correcting cylinder is placed in position and all spherical power is removed. The subject is directed to watch the Snellen types, and plus spheres in quarter diopter steps are added until the limit of clarity is reached, the eye is then fogged by an over-correction and the spherical power slowly reduced until the best visual acuity is obtained. Both eyes are dealt with in this fashion and then the binocular test is taken, the final step of which is to again fog and then reduce for the greatest degree of clarity that can be obtained. The results so found are dependable and form the basis for the future work on the case.

Some of the examples appear to have a disparity in accommodative balance and because of this it is necessary that the possibility of its pres-

ence should not be overlooked, although if the method indicated above is used it does not occur as frequently as one may be led to believe. Disparity in the monocular and binocular retinoscopic results when the eyes fix at six metres is probably the first indication that will be found, but it is usual to discover it when the dynamic method with fixation within optical infinity is employed. The indications can be confirmed and developed by some form of a distance visual balance test and with the comparison test at near. In many instances the older idea of setting the Jaeger type at some set near position and fogging and defogging monocularly is of distinct service for any essential disparity between the results for the two eyes points to the existence of a real monocular latency or rather excess latency that is by no means invariably revealed by comparison tests. If all the indications show that such a disparity exists, then the refractionist need have no hesitation in correcting it in full. Unless there is collateral confirmation of the existence of a disparity, any that is shown by a comparison test should be treated very conservatively because it is possible that the showing is spurious, and is a legacy from the previously uncorrected condition. It occurs as a fault of perception rather than an error of accommodation, and before any specific correction is attempted it is advisable to let the conventional correction be worn.

It has been noted that use of weak base-in prisms has very definite effect in the treatment of many of the cases of migraine. The value of such prisms has been proved in other conditions, but the exact manner in which they are effective is far from clear. So far as migraine is concerned the result seems to depend upon the relief given to the convergence, for, as we have found, a tendency to over-converge which may or may not be shown as an esophoria is not infrequently associated with the condition.

It is usual to consider that a manifestation of esophoria at the near point of regard is indicative of such tendency but it can be present when the dissociation tests reveal exophoria. If we examine the tendencies which are present when the eyes are engaged in binocular vision, as with the Diploscope, it is not uncommon for the exophore to have this particular one. A moment's reflection will show why this occurs. The subject with exophoria must exert greater convergence than the orthophore, and so when the actual state of the convergence is examined the tendency to overshoot the mark becomes manifest. In this way it is apparent that many of the conditions which, following Cantonnet, have been called

Binocular Instability are nothing more than examples of exophoria. (Genuine binocular instability probably exists in hysteria only.) When the base-in prisms are applied the demand upon the convergence becomes less, hence the effort to fix the object of regard falls well within the scope of the subject's capabilities and so the symptoms cease.

Sometimes this tendency to over-converge is shown in the dissociation test as an esophoria, and such a finding does not in any way invalidate the observations made above. About forty years ago Dr. E. T. Allen pointed out that most of the examples of esophoria were really reversed exophoria and because of this should be treated as the latter condition. There can be no doubt that some of the types of esophoria which are seen are spurious and are manifested under the dissociation test because of physiological habit. A true esophoria is rare, but functional esophoria is common and is usually amenable to the optical treatment given to associated ametropia. Although it is frequently stated that the manifestation of esophoria under dissociation tests is evidence of latent hypermetropia, such a statement is not strictly true. The relationship of heterophoria to concealed ciliary function has never been properly investigated and one can but regret that facile cerebration on the part of a writer has often given place to clinical research. Functional esophoria which does not respond to the refractive correction can be attended to by base-in prisms.

The effect of base-in prisms is to remove the apparent position of the object of regard and so the demand upon convergence is less, hence we see that the tendency to over-converge has little or no incentive to express itself and therefore the entire binocular function takes place with less effort. The relief thus given is of distinct value to the subject with migraine, for it enables him to conserve the nervous energy which is such an important factor in the condition, the demands upon which may be the sole reason why he suffers from his particular trouble.

One of the effects of the use of base-in prisms is the stabilization of the refractive error: often this means a complete change, so that when the new correction is supplied all symptoms cease. One case of this type was first seen on July 1, 1937. The refraction worked out with crossed cylinder and Snellen letters was:

R.E. 6/9, + 0.5 D.C. ax. 80°=6/6.

L.E. 6/9, +0.5 D.S. +0.25 D.C. ax. 110° =6/6.

Base-in prisms of 1.0 △ for each eye were given and the correction caused a marked drop in the frequency of attacks.

On July 5, 1938, the refraction was again worked out by the same method with the following result:

R.E. + 0.5 D.S. —1.00 D.C. ax. 170° =6/6.

L.E. + 0.25 D.S. + 0.75 D.C. ax. 100° = 6/6.

The new correction was fitted, and since wearing it the migraine has disappeared completely. Similar changes have been noted in other cases, and one of the most marked features has been the full manifestation of astigmatism. One point may be emphasized relative to the presumed accuracy of the findings on each occasion: the astigmatism was worked out by means of a crossed cylinder and Snellen types at six metres and checked for amount and axis at near using the same crossed cylinder and the hand types. It would appear that this is the most satisfactory of subjective methods.

Objection has been raised against the arbitrary prescription of base-in prisms. The force of this objection was fully appreciated by the present writer and attempts were made to work out the prism power according to the indications of the test for the horizontal fusion reserves, but there was little or no advantage gained by this, and it was later discontinued so far as migraine was concerned. Indeed, one is inclined to look upon the value of some duction and fusion reserve tests as being in many instances seriously overrated, although one has no desire to belittle the real worth of such tests when properly made. In migraine we may say that no matter how the degree of base-in prism is determined, whether in an arbitrary manner or as a result of computation, the effect is the same. The larger utility of base-in prisms in applied refraction is well known and, indeed, an entire volume could be devoted to it.

It is somewhat surprising that in these days when so much interest is displayed in the subject of orthoptics that extensive claims have not been made to cure migraine by such methods. It is generally understood that the simpler forms of orthoptic treatment are concerned with the development of the relative duction powers. Many marked examples of migraine are associated with low duction values and in consequence are presumably candidates for such treatment.

In optical circles apparently nothing of any significance has been done, but a distinguished medical orthoptist, Dr. N. A. Stutterheim of Johannesburg, whose teaching differs so markedly from what is usually accepted, has maintained that he has been able to influence the condition. He claims that the power of convergence is not adequate to meet environ-

mental demands, with the consequence that many of the people who complain of eyestrain are really suffering from what he calls Asthenovergence. He has worked out a simple technique by which he states this can be remedied. In his study of his teaching relative to migraine he gives an excellently reasoned argument for the relationship of asthenovergence to the condition.

Whether the perfectly sound criticism which has been directed against orthoptics is valid here is not of present moment. Some of his suggestions are attractive. He states that the peculiar influence asthenovergence has on the general nervous system can be well seen in ophthalmic migraine, and indicates that he has often encountered cases where eyestrain has been associated with migraine which has responded to his special treatment.

He maintains that the kinetic principle of binocular vision, the act of convergence, is an occipital occurrence, and he suggests that a change in occipital function may influence the blood flow in that region, and states further that "methodical calling on the power of convergence is bound to bring some change in the vasomotor conditions of the brain area involved." He supports his argument by collateral references and concludes by saying that his mode of treatment cures eyestrain and is not intended to cure migraine, but maintains that relief can be obtained. He makes the significant remark that migraine is not an ocular disorder but is more probably an allergic one. He quotes several cases in which his relatively simple methods of treatment have relieved the condition.

The work of Dr. Stutterheim should be more widely known in orthoptic circles, for while it is very simple it is also somewhat revolutionary in its conception. The present writer, though critical of much that passes for orthoptics, has tried out the technique in several cases, though not in migraine, and has found that, as is usual with orthoptic treatment, it is possible to submerge the various symptoms of the conditions. The fundamental claims of Stutterheim appear to be very similar to those of the redoubtable American, Arneson, though they are not presented in the same manner. The study of Dr. Stutterheim's contentions on migraine gives one an interesting conception of the relationship of the condition to its ocular concomitant, whatever else one may think of his technique.

It is not the purpose of the present paper to discuss the wider problems of migraine, but reference can be made to the series of observations

which were published in the issue of the *Optician*, May 12, 1939. The matter had to do with the consideration of the peculiar headache which is found in migraine, and it was there noted that several workers had remarked upon the fact that pressure upon the carotid, occipital, temporal and angular arteries will relieve it. When the pressure is removed the headache returns with intensity, and from this one may infer that the headache arises from the stretching of the coats of the arteries concerned. Certainly the vascular condition has an important part to play.

It cannot be too strongly emphasized that migraine is the name given to a group of symptoms the most characteristic of which is the peculiar form of headache which is always found in the true condition. Occasionally this headache when existing alone is confused with a similar headache which is found in some cases of vertical heterophoria, indeed this latter can be responsible for a state of pseudomigraine which it is at times very difficult to distinguish from the other, especially is this so in paretic vertical heterophoria. The existence of hyperphoria in a case of migraine should cause the examiner to take extensive tests to determine its nature, i.e., whether it is of a pathological type or not. The usual tests for extra-ocular paresis are generally sufficient, but the value of monocular duction tests in the two cardinal vertical directions should not be overlooked. We have also certain examples of true migraine where the train of symptoms takes its rise from the existence of the hyperphoric condition and so with its adequate correction the symptom complex disappears. A distinguishing feature of the headache of migraine is its paroxysmal character; it usually begins at one side of the head and develops, the pain in hyperphoric headache is more localized in position and it is frequently possible to elicit tenderness of the supra-orbital ridge on digital pressure, but here again we occasionally encounter conditions which are easily confused.

It has been noted that vomiting or a tendency to vomit is fairly frequent in migraine, and the sick headache has become associated with this in the lay mind, but vomiting can occur with paretic heterophoria, or at least the tendency thereto can be exhibited. Characteristic of the condition when it occurs is the photopic phenomenon which is never found in vertical heterophoric complications, and if we can have the patient make the observation accurately it is of diagnostic value.

It has been mentioned above that pressure on certain arteries will cause the headache to disappear, and if such pressure can be instituted

while an attack is in progress the result should satisfy the examiner as to the nature of the condition with which he is called upon to deal. It is not a difficult matter to have the patient call when an attack is just starting, for if they are convinced that the practitioner is attempting a scientific study of their individual condition these patients are generally willing to cooperate for that purpose.

One should note that during the examination for the basic condition in migraine it is often possible to isolate a genuine case of ocular neuralgia, and if such is present its existence should be determined at the earliest possible moment, for none of the agents available to the refractionist are of any help.

It is not our present purpose to review all the proposals which have been made to combat the condition. Treatment by means of drugs is in other hands than ours, and the results are generally uninspiring. The common practice of supplying sleep-producing drugs is a tacit confession on the part of organized medicine that it can do but little, and in the absence of a more accurate knowledge of the fundamental pathology of the condition this is to be understood. Intravenous injections of ergotamine tartrate have been found to relieve the headache, and have been of service in the study of the relationship of the intensity of the headache to the amplitude of arterial pulsation.

The distinguished clinician, Dr. Albert Abrams, while investigating the therapeutic effects of spinal percussion treated about eight cases of migraine by concussion of the seventh cervical vertebra with the result that four of the cases were cured, two were improved, and two remained unaffected. The treatment was given in the inter-paroxysmal periods. This particular mode of therapy was based upon a theory held by Abrams that the condition was due to an instability of the vasomotor centre in the spinal cord.

The clinical interest of the refractionist in conditions of migraine must of necessity be limited, but sufficient has been said to demonstrate the value of optical treatment in many examples of the condition; much more work is required before the principles of a definite technique can be laid down, while collateral work on its pathological and psychological aspects remains to be done. The fundamental cause of the condition is unknown and will probably remain so for some considerable time. A certain well-defined type of person is particularly prone to migraine and from what we know at present the basic ocular condition which in others

would be considered the cause of an asthenopia can in these individuals produce the symptoms which are recognized as characteristic of migraine.

The psychological aspects of migraine offer ample scope for speculation based upon the careful observation of the individual, for there can be no doubt that mental disposition has a great part to play. One case known to the writer was that of a young female, whose family had an exceedingly exaggerated idea of their own social standing and importance. The girl, the possessor of a respectable science degree, was far happier when she was away from her home circle and was perfectly free from migraine when at college, but had repeated attacks of it on her return home. She became free of it by making a complete divorcement from her own people. One has no need to be a disciple of Adlerian psychology to appreciate the full meaning of such things. The suggestion of M. B. Jenson that migraine has an emotional basis is perhaps not far from the truth. Such considerations, however, belong to other pages than the present.

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THE IMPORTANCE OF ATTENDING PROFESSIONAL ACADEMY MEETINGS

It is important that members of a profession belong to, and attend meetings conducted by that profession so as to make contact with other members, keep informed as to what technical changes are taking place, and what other members are accomplishing. Optometrists should attend professional meetings both to derive knowledge from others and to contribute whatsoever they can from their own practical experience.

It should not be necessary to call these facts to our attention, but when one realizes the number of optometrists who take no part in local societies or in any state or national organization, one feels that too much

cannot be said on the subject and an occasional reminder is therefore pertinent.

To be a member of the optometric profession one should be conscious of two serious ends to be achieved. These are, first, an ideal of satisfaction in ones own knowledge and ability; and second, an ideal of service which the optometrist may render to those who rely upon his skill and judgment. Students preparing themselves for an optometric career should desire to know and understand as many facts and to acquire as much knowledge in their professional duties as their innate ability provides. We all agree that no one will admit that his native ability is inferior to another's, even though he must admit another's superiority in accomplishment and renown. What then is the secret of success and progress in some and the obvious failure in others?

Members of the Academy recognize this truth, that progress in ocular refractive work has been dependent upon facts, observations, and conclusions communicated from teacher to student and from optometrist to optometrist. These facts are then recorded for future generations. That is the job of this technical journal. Future generations, each in turn building upon the foundation work laid by former generations. The advancement in optometry or any profession being in direct relationship to the facilities provided by the profession for exchange and interchange of facts, information, techniques and skills and the proper use of these facilities. In all this the Academy plays an important part in the development of optometry.

The meetings of the Academy itself and the meetings of its local chapters do much in promoting this work, and the proposed new activity of student chapters in our colleges will add still more to our widening program of technical betterment. Academy leaders have long recognized that no practitioner can successfully hold his place in the professional life of his community without these aids. A good background of technical schooling is not enough. No optometrist after leaving his college or university can say to himself, "I am properly prepared and I know all the facts worth knowing about ocular problems and refraction."

Academy leaders in optometry have realized, to the ultimate advantage of all optometrists, that college training is not enough. They have realized that the practitioner who has begun the practice of his chosen profession needs to keep in touch with developments, and also needs to go on learning the techniques and new methods being applied

by optometrists in different parts of the country.

With this in mind, Academy officers are urging the formation of new local chapters through which new ideas and new knowledge may be transmitted to those optometrists who are unable to travel and whose practices keep them so busy that they have little time for individual home study.

Academy leaders have learned that by professional contacts or association, an optometrist is given greater power for growth. An important war-time assignment of the Academy is to improve the facilities for these contacts. Optometrists who take advantage of these opportunities will learn new, useful facts. They will acquire new ideas which in turn will form a basis for their own personal experimentation. Thinking will be stimulated and the practitioner will find himself in a position to render greater service to his patients because of his professional associations.

Leading optometrists realize that the discharge of their knowledge to those who depend upon them presents an obligation of a professional nature which they are willing to assume. Optometric ethics demand that new discoveries and new processes be given the entire profession for the use of all who may benefit thereby. In this work the Academy has already played a leading role, and to those who would keep pace with the progress being made in optometry, the Academy offers its fullest cooperation.

CAREL C. KOCH.

BOOK NOTICES AND REVIEWS

Books received are acknowledged by notices in this department. Special selections will be made for more extensive review in the interest of our readers as space permits.

THE HUMAN EYE IN ANATOMICAL TRANSPARENCIES.

P. C. Kronfeld, Gladys McHugh and S. L. Polyak. Published by the Bausch & Lomb Press. 34 transparencies. Illustrated. 99 pages. Cloth. $6.50. 1943.

This new text on the human eye is notable for a series of 34 natural color paintings which reproduce in stereographic form the complete serial dissection of the eye and orbit. This anatomical work has just been issued by the Bausch & Lomb Press. The book represents the collaboration of two outstanding authorities on the eye, Peter C. Kronfeld, M.D., and Stephen L. Polyak, M.D. The color paintings are by the talented

medical illustrator, Gladys McHugh, of the University of Chicago.

Miss McHugh uses a new method of graphic representation, in the reproduction of the paintings, which have the effect of providing the reader with a translucent, three-dimensional model of the object which can be cleaved at will along any one of a number of planes. The usual drawings of the separate parts of the eye tend to isolate them from each other and fail to afford an easily grasped idea of the spatial relationship of these parts. The illustrations of Miss McHugh are essentially topographic. Where there was natural stratification, the structures encountered were removed layer by layer in the sequence in which they present themselves to the dissecting knife. Miss McHugh was a student of the late Max Brödel, of the Johns Hopkins Medical School. She has followed the advice given to her to make her own dissections in order to make an accurate portrayal. Starting with dissections on cadavers and attending a number of eye muscle operations, she made a total of twenty dissections of eyes and orbits, making color notes and drawings from fresh specimens.

The drawings on these transparent plates are reproduced twice the actual size of an adult eye. In the case of the veins and nerves, which appear respectively in blue and yellow, some realism has been sacrificed to diagrammatic representation in order to distinguish them from arteries. The optic nerve, however, is shown in natural color. Because of the pictorial accuracy of the paintings and the method by which the dissections have been assembled, these anatomical illustrations will prove extremely valuable in teaching and useful to the optometrist in reviewing the anatomy of the eye or explaining pathological conditions to his patients.

Dr. Peter C. Kronfeld, director of education at The Illinois Eye and Ear Infirmary, and associate professor of ophthalmology at Illinois and Northwestern Universities, has written the text and supervised the work of Miss McHugh. The text has been organized to present not only a systematic account of ocular anatomy, but also a topographic treatment as it presents itself in Miss McHugh's paintings. In the topographic section, some additional illustrations, fully labeled, have been provided for purposes of sure identification.

This modern treatment of the subject by Dr. Kronfeld and Miss McHugh is supplemented by Dr. Polyak's historical section which indicates how far we have progressed in our knowledge of the eye and methods of illustrating it since ancient times.

According to Bausch & Lomb, the process by which the color paintings are reproduced is the first five-color process rotogravure to be produced on an acetate base in which every color involved tone etching. The registry of the various layers is perfect. Essentially, the method reproduces a series of front and back illustrations of sectional parts in register so that the resulting picture becomes a whole object. The McHugh paintings in this collection represent the most delicate and definitive work so far produced by gravure craftsmanship, and also constitute a real contribution to ocular literature.

G. L. DU PLESSIS.

ABSTRACTS

A department in which will appear abstracts of the literature of optometry, ophthalmology and applied optics. These will be classified according to the following list. although contributions to all sections will not necessarily appear in each issue.

1. Ocular Refraction.
2. Physiological Optics and Color Vision.
3. Ocular Muscles.
4. Orthoptics and Reading.
5. Anatomy, Histology and Embryology.
6. Ocular and General Pathology.
7. Ophthalmic Lenses and Material.
8. Instruments.
9. Hygiene and Illumination.
10. Applied and Physical Optics.
11. Education, Sociology and Economics.
12. Miscellaneous.

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2. PHYSIOLOGICAL OPTICS AND COLOR VISION

✓ COLOR TECHNIQUE IN INDUSTRY. F. Birren. Sight Saving Review. 1943, 13, 1, 3-11.

Unlike critical seeing tasks which demand prolonged concentration of the eyes in one restricted field of view, the more general safety measures of a plant call for extreme contrast and intensity of color. The marking of aisles, pillars, doorways, dead-ends, the identification of hazardous parts, moving objects, low beams, hot pipes, the regulation of traffic in crowded areas or down dim passageways—all these call for a more vigorous technique. Yellow is the color of highest visibility in the spectrum. Next in order is yellow-green, then orange, then red. While white holds its brightness under all lighting conditions, it lacks impulsive attraction to the eye and hence is not very compelling. Good safety practice therefore will keep such functions and purposes as these in mind: Yellow, being the most conspicuous of all colors, should be used where hazards are critical—off-and-on switches, danger zones, low beams, moving parts, etc. Yellow-green and orange may then be given other jobs to do —curbing, rails, boxes, cranes, trucks, etc. Order and significance may

thus be intelligently worked out, with color employed for a specific rather than random impression on the worker. Yellow he watches with a wary eye; yellow-green he avoids somewhat gingerly; and orange he knows must merely be respected—for the dangers marked by each color have this relative importance. Red may logically be reserved for fire apparatus, fire doors, exit signs, lines, etc. This acceptance is today universal and should be preserved. L. P.

THE VALUE OF THE PSEUDO ISOCHROMATIC COLOR VISION TEST IN ORIGINAL APPLICANTS FOR MILITARY FLYING. M. S. White, Military Surgeon. 1941, 89, 801-805.

It is apparent, claims White, that individuals who fail only the Ishihara test and are able to qualify, according to present military regulations, by selecting the cardinal colors of red and green, are deficient in three of the main requirements of color visibility required for the military pilot. These borderline cases will interpret any color correctly if sufficient saturation of that color is presented to them. However, this condition will not always exist in the rigors of military service. It is believed that the Ishihara test, modified to prevent its commitment to memory, is sufficiently discriminatory to select the military pilot without time-consuming methods of examination. If an applicant, on the original examination, fails the Ishihara test or modification of it, he should be disqualified without further investigation.

Individuals who are color deficient as revealed on the Ishihara plates but able to select gross shades of red and green, were shown to be deficient in three of the main requirements of a military pilot with reference to color vision, namely, recognition of Very pistol Signals, Navigation Lights, and map color shades. Failure on the Ishihara test or a modified similar Pseudo-Isochromatic plate test should be considered disqualifying for original applicants in Military Aviation.

A. V. F.

MECHANISM OF ACCOMMODATION. M. Koke. Archives of Ophthalmology. 1942, 27, 5, 950.

A method is described whereby the interior of an intact living eye may be pictured on a roentgenogram, and the roentgenologic findings were corroborated by gross dissection and microscopic studies.

G. L. DU P.

A REVIEW OF COLOR VISION WITH SOME PRACTICAL SUGGESTIONS FOR MEDICAL EXAMINERS. A. Schwichtenberg. Archives of Ophthalmology. 1942, 27, 5, 887.

A correct but not original technic for the Holmgren yarn test is presented.

A technic for the Williams lantern test is suggested, simulating conditions of military operations more closely than other tests of color vision.

The suggestion is made that the time-consuming Holmgren yarn test be omitted together with the Edridge Green classification of color vision defects based on the color confusions recorded in this test. This suggestion is based on the results of a study made at the School of Aviation Medicine indicating quite clearly that about three-fourths of the examinees who made mistakes on the Ishihara plates could not be qualified or disqualified on the results of the Holmgren yarn test used as a "confirmatory test" for the Ishihara test.

From the same study it was apparent that the idea commonly held by flight surgeons that the Ishihara test does not require any confirmatory test could not be entirely substantiated. This is based on the fact that 20 per cent of those who make mistakes on the Ishihara test do not make significant errors on the Williams lantern test and therefore could be qualified. For all practical purposes it is reasonable to assume that they will not make mistakes under ordinary circumstances.

It is recommended that the Williams lantern test be used in place of the Holmgren yarn test as a confirmatory test since it is simpler, several examinees can be tested at once, and, with the technic outlined, a written record is available which can be compared with the key.

L. P.

EDRIDGE-GREEN ON COLOR BLINDNESS. Editorial. Optician, (London). 1943, 105, 2706, 9.

On examination with the Edridge-Green color vision spectrometer, with which any portion of the spectrum can be isolated between two definite wave-lengths, it is found that people vary considerably not only in the number of colors seen in the spectrum, but also in the number of monochromatic divisions seen. Most normal-sighted persons, according to Edridge-Green see about 18 monochromatic divisions. That is to say, there appear to be 18 different hues in the spectrum.

L. P.

"IMPROVING" COLOR VISION. C. S. Bridgman and H. W. Hofstetter. Optometric Weekly. 1943, 34, 16, 471-73.

During the past year it has become a part of the regular practice of many optometrists to give treatments for colorblindness to men who have been rejected from military service because of failure in the color test.

The authors describe a series of tests made with these treatment techniques at the School of Optometry, Ohio State University. Their results with these techniques were negative and they come to the following conclusion: "In normal times the treatment of color blindness might be justified on the basis that there is a possibility of improvement, however remote. This philosophy of treatment is widely used in other situations, both by optometrists and other health practitioners. In the absence of complete knowledge it must be used. But it can be justified only in situations where apparent success can not possibly lead to the acceptance of responsibility which the patient cannot fulfill, as may happen now in the case of the applicant for military service who erroneously believes himself cured of color blindness."

C. C. K.

COLOR DESIGNATIONS FOR LIGHTS. K. L. Kelly. Journal of the Optical Society of America. 1943, 33, 6, 349-350.

The author points out that ever since the development of the International Society Color Council-National Bureau of Standards (ISCC-NBS) system of color names for the description of colors of drugs and medicines, a need has been recognized for a system of color names for the description of the colors of lights. Somewhat conflicting color names are regularly used in the description of the colors of flares, landing lights, and some beacons and signal lights. A tentative extension of the ISCC-NBS system has been worked out for lights. The color names consist of high value hue names such as red, pink, orange, green or purple, but no low value hue names such as brown or olive. Modifiers are not used because the conditions of lighting and viewing are too variable and because the problem is usually one of separating lights of different hues.

A. V. F.

DESCRIPTION OF A SUBJECT CONGENITALLY DEFICIENT IN VIOLET-YELLOW VISION. D. Farnsworth. Journal of the Optical Society of America. 1943, 33, 6, 350.

"Father and two sons exhibit the three known types of dichromatic vision—the father is violet-blind, one son is red-blind, and the other green-blind. The father, Mr. V., has a personal history of health, free from accidents, and exhibits no ocular abnormalities. Instances of specific confusions of violet with yellow, blue with green, and orange with red-purple have occurred since his twentieth year. Mr. V. gives normal responses on all pseudo-isochromatic plates, passes the ISCC Red-Green discrimination test and a replica of the Canadian Lantern. However, he tests violet-yellow anomalous on the Farnsworth Dichotomous Panels and the F-M 100-Hue Test, and matches, with slight adjustment in brightness, all Munsell colors on the same value level which parallel the purple-redpurple and yellow-greenyellow axis. The violet region of the spectrum is invisible to the subject and a neutral division occurs where normals describe yellow. Any part of the spectrum can be matched in hue with any other part on the same side of neutral."

A. V. F.

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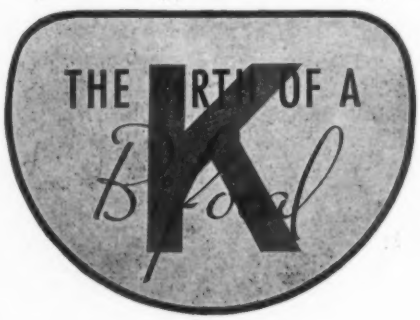

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2928 Lyndale Ave. So. -:- MINNEAPOLIS, MINN.

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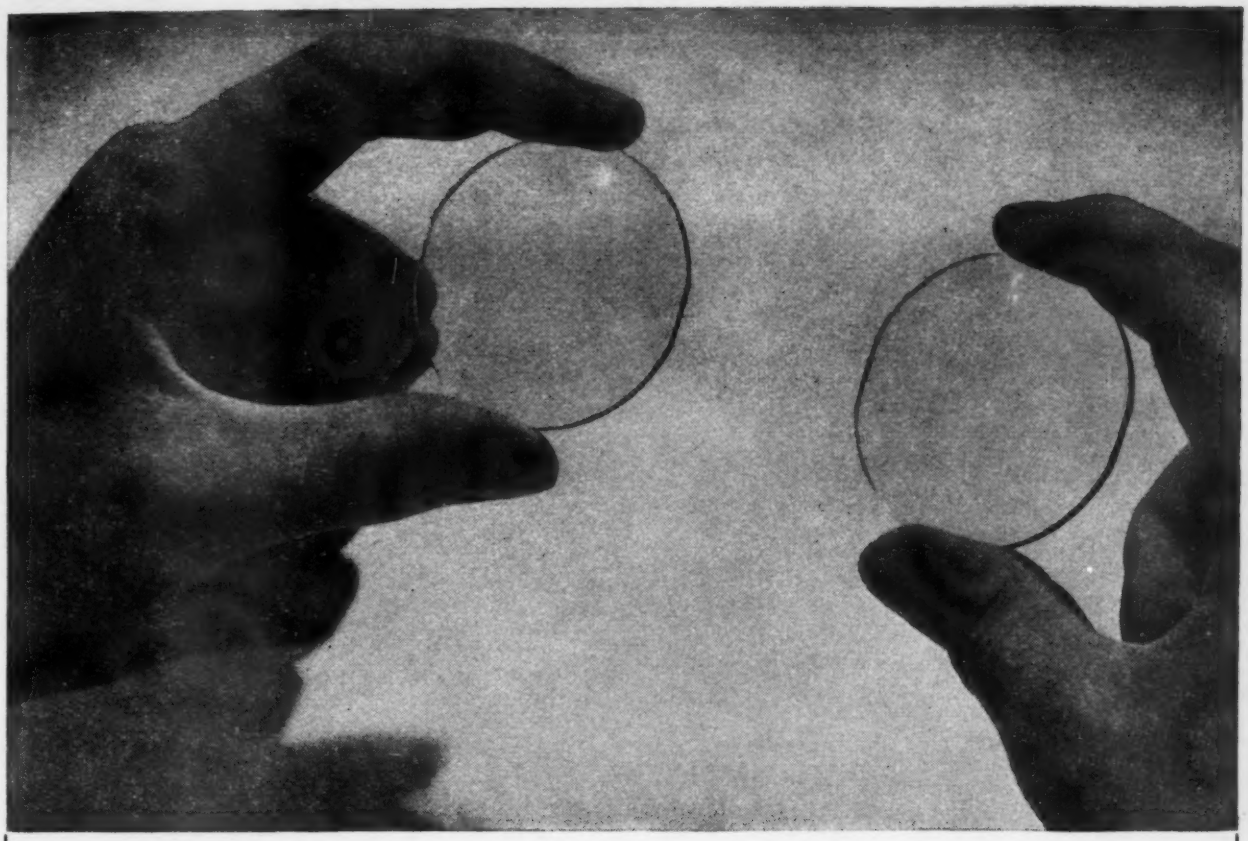


Character: IDENTICAL

Contrary to what might be supposed, there is a closer bond of similarity between Soft-Lite and white crown lenses than between Soft-Lite and other absorptive lenses.

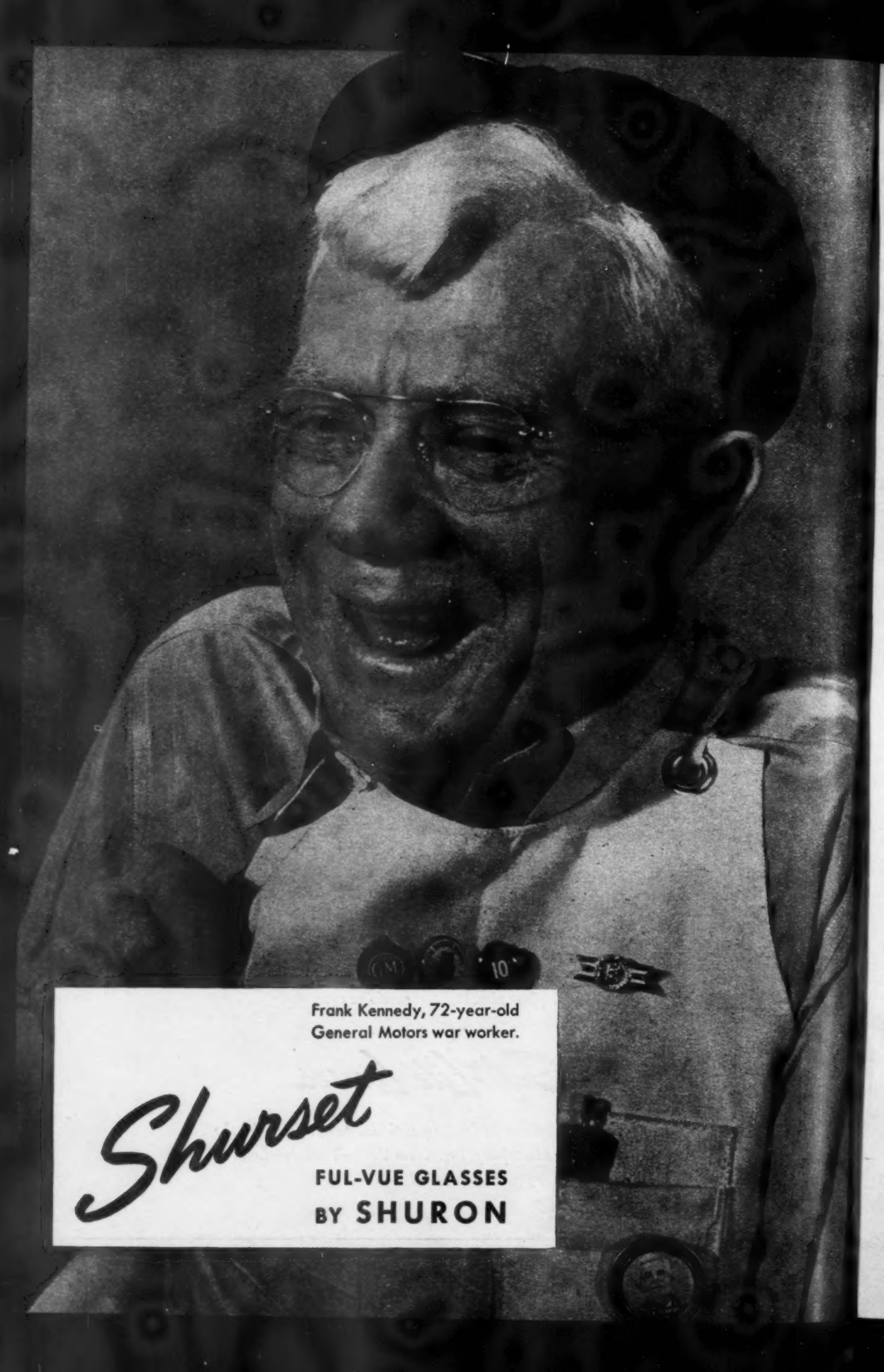
This is because *both* Soft-Lite and white crown lenses provide *neutral light absorption.*

When white crown lenses are worn, they introduce approximately an 8% reduction in light transmission. In cases of photophobia, however, this decrease in light intensity is often not sufficient to bring complete comfort.

So, when additional light reduction is needed, Soft-Lite Lenses are those most commonly prescribed. Like white crown lenses, they reduce the quantity of light without affecting light quality. They provide true neutral, natural light absorption in the amounts needed to bring comfort to glare-sensitive eyes.

Soft-Lite Lenses

Ethically advertised in leading national publications by the Soft-Lite Lens Company, Inc., New York—Toronto—London



Frank Kennedy, 72-year-old
General Motors war worker.

Shurset

FUL-VUE GLASSES
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